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Protecting Progress and Privacy: The Challenges of Smart Grid Implementation

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Abstract: The smart grid has the potential to be one of the most significant innovations of the twenty-first century from an economic, environmental, and social standpoint. The interconnectedness and increased communication throughout the grid will likely create many significant benefits and increase the consistency of the flow of electricity to consumers. At the same time, however, the smart grid's reliance on consumer information, much of which can be highly personal poses raises major issues regarding personal privacy.

This Note will analyze some of the potential frameworks of the smart grid and analyze the positives and negatives of each form from a privacy perspective, keeping in mind the social benefits that each form can provide. Because the smart grid remains in the experimental and design phases of its lifecycle, pushing for one particular method of protection before it is fully tested could cancel out some of the benefits that the smart grid will hopefully provide for society. At the same time, a failure to account for privacy rights at this stage could result in costly litigation and a re-designing period that could hinder the progress of the grid. Grid designers should therefore give consideration to privacy rights during the current design process—and not after the fact, as has been the trend with other new advancements—to ensure that the structure of the grid will account for and protect personal privacy rights as a default.

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I. INTRODUCTION

From digital televisions to electric toothbrushes, technological innovations continue to benefit society by enhancing recreation and simplifying essential activities. These advancements have permeated many elements of everyday life, increasing society's dependence on energy in the process. Ironically, however, the power grid that most of these products depend on remains flawed and outdated.

Ideally, the same technology found in new products can also be used to create a more efficient grid that fulfills modern needs. Recent commercial and governmental investments, including $3.9 billion in federal stimulus funding, suggest that the smart grid may be the solution for many energy issues.[1] The smart grid is a collection of components that will use "digital technology to improve the reliability, security, and efficiency of the electric system."[2] Specifically, this system will gather greater amounts of consumption information and, through a more flexible infrastructure, utilize that consumer data to allocate energy more effectively. As with other digital advances, however, the enhanced capacity created by the smart grid to collect, store, and use personal information will pose significant privacy concerns.

Analyzing the potential privacy issues while the smart grid is still in the conceptual stage, though they may prove to be no more than theoretical, may help ensure that appropriate technological, legal, and political consideration is given to individual rights. Such an approach may prevent costly litigation and political problems that could hinder the continued progress of the smart grid system.

Up to this point, there has been little federal protection of energy usage data. Recently in Austin, Texas, law enforcement with unfettered access to individual energy consumption data used mass surveillance techniques to locate anomalies in consumption and target

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[1] Kate Galbraith, *Obama Signs Stimulus Packed With Clean Energy Provisions*, Green: A Blog About Energy and the Environment, http://greeninc.blogs.nytimes.com/2009/02/17/obama-signs-stimulus-packed-with-clean-energy-provisions/?scp=3&sq=smart%20grid%20stimulus&st=cse (Feb. 17, 2009 15:40 EST).

[2] U.S. DEPT. OF ENERGY, SMART GRID SYSTEM REPORT 1 (2009), *available at* http://www.oe.energy.gov/DocumentsandMedia/SGSRMain_090707_lowres.pdf (This report also includes a diagram of the components of the smart grid, reproduced here in App. A).

investigations of drug production.[3] Despite the speculative and personal nature of the surveillance, the police department remains "confident that the measures it utilizes follow the law."[4] A federal judge agreed, denying a motion to suppress evidence and stating that accessing energy data "does not violate any protected privacy interest."[5]

Now that Austin has become a smart grid testing site, government agencies and potentially other parties would appear to have unrestricted access to greater amounts of energy data that may reveal highly personal information.[6] For example, much like how behavioral advertising has evolved through the Internet, a consumer's choices and behaviors could be collected and analyzed to create a highly detailed profile. This collected information could then be used without the consent of the consumer by advertisers or other, less legitimate parties who seek to gain an advantage over the consumer. A scenario of limitless access to personal energy consumption data may bring about high litigation costs and a public relations and political backlash that could hinder the grid's development and capabilities. Along with avoiding future costs, there may be significant advantages for private corporations to integrate some protections of individual privacy rights when designing the elements of the network.

II. THE SMART GRID OFFERS MODERN SOLUTIONS TO LONG-STANDING PROBLEMS AND MAY PROVIDE SIGNIFICANT BENEFITS TO SOCIETY.

Today's power grid has little flexibility in dictating where to send energy within the grid, making it obsolete when dealing with modern problems and physical interferences. Under the current system, the power grid can transmit power in only one direction—from source to

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[3] Jordan Smith, *APD Pot-Hunters Are Data-Mining at AE*, THE AUSTIN CHRONICLE, Nov. 16, 2007, *available at* http://www.austinchronicle.com/gyrobase/Issue/story?oid=oid:561535.

[4] *Id.*

[5] U.S. v. Colby, No. A-07-CR-072-LY at 14 (W.D. Tex. Nov. 6, 2008) (Order Den. Def.'s Mot. To Suppress Evidence).

[6] Bruce Sterling, *The Austin Smart Grid*, Beyond the Beyond, http://www.wired.com/beyond_the_beyond/2008/12/the-austin-smar/ (Dec. 11, 2008, 03:32 EST).

consumer—and lacks access to instantaneous consumer usage data.[7] As a result, fairly ordinary occurrences like sudden increases in power demand during peak hours, downed power lines, or drops in energy production can result in costly power outages.[8] The Northeast Blackout of 2003, for example, brought about at least $4 billion in losses for energy users,[9] and businesses expend as much as $100 billion per year to resolve blackout issues.[10]

Along with significant financial costs, blackouts and brownouts also raise significant health concerns. Water filtration systems,[11] heating and air conditioning systems, health-care equipment used without a backup generator,[12] smoke and carbon monoxide detectors, and traffic lights all depend on a consistent flow of energy when helping to provide safety. Furthermore, because many lines of communication rely on power from the grid, individuals may lack adequate means to call for help during an emergency.

The grid's inability to adapt also prevents the widespread use of many cleaner forms of energy. Wind and solar power generators, for example, often depend on specific weather conditions to produce energy. Thus, a shift in the weather may yield a sudden drop in power supply, which the current power grid would struggle to

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[7] INFO. AND PRIVACY COMM'R, ONTARIO, CANADA & THE FUTURE OF PRIVACY FORUM, SMARTPRIVACY FOR THE SMART GRID: EMBEDDING PRIVACY INTO THE DESIGN OF ELECTRICITY CONSERVATION 3 (2009), *available at* http://www.futureofprivacy.org/wp-content/uploads/2009/11/smartprivacy-for-the-smart-grid.pdf. *See also* Brandon I. Koerner, *Power to the People: 7 Ways to Fix the Grid, Now*, Wired Mag., Mar. 23, 2009, *available at* http://www.wired.com/science/discoveries/magazine/17-04/gp_intro?currentPage=all (last visited Apr. 18, 2011).

[8] ROBERT D. ATKINSON, DANIEL CASTRO, & STEPHEN J. EZELL, THE INFO. TECH. AND INNOVATION FOUNDATION, THE DIGITAL ROAD TO RECOVERY: A STIMULUS PLAN TO CREATE JOBS, BOOST PRODUCTIVITY AND REVITALIZE AMERICA 5 (2009), *available at* http://www.itif.org/files/roadtorecovery.pdf.

[9] THE ELEC. CONSUMERS RES. COUNCIL (ELCON), THE ECONOMIC IMPACTS OF THE AUGUST 2003 BLACKOUT 1 (2004), *available at* http://www.elcon.org/Documents/EconomicImpactsOfAugust2003Blackout.pdf.

[10] *See* Atkinson, *supra* note 8.

[11] KAREN M. E. EMDE, ET AL., ESTIMATING HEALTH RISKS FROM INFRASTRUCTURE FAILURES 17 (Am. Water Works Ass'n 2006).

[12] Robert Higgs, *Power Outage Potentially Deadly For Those On Home Life Support*, Cleveland.com, http://blog.cleveland.com/health/2009/01/power_outage_potentially_deadl.html (Jan. 12, 2009, 13:55 EST).

accommodate.[13] As a result, grid systems rely primarily on more traditional forms of power production such as fossil fuel combustion or nuclear energy that turn out power consistently but may have a more significant impact on the surrounding environment.[14]

Like many technologies, the power grid could benefit significantly from increased usage data. Unfortunately, the current grid provides only monthly access to consumption figures that energy companies use primarily for billing purposes.[15] While this system provides inherent privacy protections, the efficiency of the grid suffers because of an inability to adjust to varying demands or run full diagnostic assessments of system operations.

A. THE NEW TECHNOLOGIES USED BY THE SMART GRID INCREASE THE GRID'S ACCESS TO DATA, AVAILABLE ENERGY SUPPLY, AND OVERALL FLEXIBILITY.

The modernized smart grid will use digital technology, interconnectivity, and continuous communication at all levels of energy allocation to distribute power efficiently throughout the coverage area.[16] Before energy is distributed, consumer usage data will be collected by automated "smart meters" that instantly send the information to switches, which are essentially small computers.[17] These switches then communicate and interact with the rest of the complex grid network in order to determine the energy demands of each area and distribute power accordingly.[18] Put more simply, smart technologies will change the grid from a one-way power transmission system into a multidirectional network allowing for the exchange of power and information between sources and consumers.[19]

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[13] Koerner, *supra* note 7 ("Store Power in Super Batteries").

[14] *Id.*

[15] Sterling, *supra* note 6.

[16] SMARTPRIVACY, *supra* note 7, at 4.

[17] Paul Hines, Josh Bongard & Melody Brown Burkins, *A Scalable Approach to Smart Grid Technology or "A Smarter Smart Grid"* 3 (Univ. of Vt. Coll. of Eng'g, Working Paper), *available at* http://www.smartgridnews.com/artman/uploads/1/hines_2009_smarter_grid.pdf.

[18] *Id.*

[19] For a more thorough description of the scope and technological factors of the smart grid, see SMART GRID SYSTEM REPORT, *supra* note 2.

The massive size of the grid— according to some estimates, a national grid network could become much larger than the Internet in terms of the total number of users and the data within the system[20]— will be a major asset and provide this largely self-managing system with more energy and information than ever before. Hopefully, the new technological approach and increased access to useful resources will help the grid prevent power outages, adapt to cleaner but variable energy inputs, and account for shifts in demand almost instantly without needing manual adjustments.[21]

1. THE VITAL ROLE OF THE SMART METER

Smart meters will play an essential role in providing energy-related benefits to individual consumers and society as a whole. For consumers, smart meters may help to lower energy costs by providing more access to specific usage data. Like the grid itself, individuals will be able to see real-time energy costs while using appliances and can modify their behavior accordingly. The access to current energy usage data could decrease energy consumption by promoting consumer awareness of energy costs, thereby lessening the national demand for energy and rewarding frugal consumers.[22]

Though they are still in the testing and design phase, smart meters have already shown the capability of fulfilling many other functions that can promote efficient energy usage. For example, by sending instantaneous usage data to the grid network, smart meters allow companies to adjust energy prices based on demand and time of day.[23] In practice, this system would allow energy companies to charge more for energy usage occurring during peak hours, thereby encouraging individuals to manage consumption and use energy during off-peak

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[20] Martin LaMonica, *Cisco: Smart Grid Will Eclipse Size of Internet*, Green Tech, http://news.cnet.com/8301-11128_3-10241102-54.html (May 18, 2009, 08:00 EST).

[21] Atkinson, Castro, & Ezell, *supra* note 8.

[22] Elias Quinn, *Privacy and the New Energy Infrastructure* 9 (Working Paper), *available at* http://www.townsend.com/Templates/media/files/media%20coverage/Elias%20Quinn%20-%20SmartGridPriv.pdf.

[23] LYNNE KIESLING, CREATING VALUE THROUGH CONSUMER-CENTERED TECHNOLOGY AND PRICING: THE GRIDWISE OLYMPIC PENINSULA PROJECT, THE IL. SMART GRID INITIATIVE, *available at* http://www.cnt.org/news/media/isgi-olypen-brief-final.pdf.

periods.[24] This new capacity for time-of-use pricing should result in more consistent energy use by the public and reduce the stress placed on the power grid during peak demand hours, when energy production can cost significantly more and is associated with greater environmental impacts.[25]

Overall, the smart grid may have significant financial and environmental benefits.[26] Studies cited by the Department of Energy estimate that a decrease in five percent of current energy use would have the environmental equivalent of taking fifty-three million cars off the road.[27] Meanwhile, its implementation will create new jobs and markets that will aid and potentially stabilize the struggling domestic economy. Estimated total financial benefits for the smart grid range between $638 billion and $802 billion after twenty years of implementation.[28]

III. THE DATA COLLECTION THAT MAY HELP PROVIDE SOCIAL BENEFITS MAY ALSO RAISE SERIOUS PRIVACY CONCERNS

Whether explicitly stated or inferred, advanced metering data can potentially reveal intimate details about an individual. Examples of what can be gleaned from analyzing information collected by the grid may include: the hours when individuals are home, what appliances they use, how long and how frequently they use those appliances, how they travel from room to room, when they take vacations, what economic class they fit into, whether they observe the Sabbath or religious holidays, what types of food they eat for dinner, and when they are most likely to alter daily routines.[29]

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[24] *Id.*

[25] *See* Yongliang Li et al., *An Integrated System for Thermal Power Generation,* Electrical Energy Storage and CO2 Capture, INT. J. ENERGY RES. (forthcoming).

[26] For a more in-depth discussion of smart grid benefits, see NAT'L ENERGY TECH. LAB., UNDERSTANDING THE BENEFITS OF THE SMART GRID: SMART GRID IMPLEMENTAL STRATEGY, *available at* http://www.netl.doe.gov/smartgrid/referenceshelf/whitepapers/06.18.2010_Understanding%20Smart%20Grid%20Benefits.pdf.

[27] BETTER POWER LINES GLOBAL, A SMART PLAN FOR ELECTRIC UTILITIES, *available at* http://www.microplanet.com/upload/Smart_Plan_for_Utilities.pdf.

[28] *Id.*

[29] INFO. AND PRIVACY COMM'R, *supra* note 7, at 10.

The personal information provided by advanced metering data would appeal to many groups for a variety of uses. Such groups may include energy companies seeking to improve service or sell information for profit, third-party companies marketing to individuals, law enforcement agencies investigating criminal acts, insurance companies seeking to identify unhealthy behaviors in order to adjust rates, criminals attempting to perpetrate illegal acts,[30] researchers looking to create new energy-related studies, and competing businesses or manufacturers who wish to access the trade secrets of competitors. While the effects of these groups' goals vary from beneficial to mildly annoying to criminal, the issue remains the same: consumers would be vulnerable to other parties who have obtained personal information about them without having to obtain their consent.

Personal characteristics can already be tracked through current smart metering technology via complex algorithms, and further metering innovations will only increase the level of information available to the grid.[31] By the mid-1980s, experimental metering devices known as non-intrusive appliance load monitors (NALMs) could determine when specific appliances were being used based on the energy usage pattern specific to each appliance.[32] Now, researchers are also experimenting with methods to determine if a running appliance is being used in an unconventional way (for example, when an individual puts shoes in the washing machine).[33] In his in-depth analysis of metering capabilities, Elias Quinn concludes that, upon implementation, smart meters will likely have the same capabilities as the experimental NALMs did in the 1980s.[34]

In the future, advancements in technology will allow more products to connect to the grid, thereby expanding the types and amount of data collected. It is expected, for instance, that automobiles

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[30] While smart grid security is a major concern, the focus of this note is regulation of voluntary conveyances of personal energy usage data. For a more in-depth look at grid security, *see* NAT'L INST. OF STANDARDS AND TECH., NIST FRAMEWORK AND ROADMAP FOR SMART GRID INTEROPERABILITY STANDARDS 106–15, *available at* http://www.nist.gov/public_affairs/releases/upload/smartgrid_interoperability_final.pdf.

[31] Quinn, *supra* note 22, at 28.

[32] *Id.* at 21.

[33] *Id.* at 29.

[34] *Id.* at 28.

will eventually link up with the grid as their primary power source.[35] These plug-in hybrid electric vehicles (PHEVs) will serve, in effect, as portable batteries that can store energy and send power back to the grid when it is needed.[36] Storage methods like the PHEV will be crucial for the grid because of the increased use of more variable forms of energy production like wind and solar power.[37] In the process of charging these new vehicles, the grid may also collect information regarding the traveling habits and daily schedules of consumers. This could well be the beginning of smart product expansion, and the grid's implementation could produce an entrepreneurial goldmine that already has "hundreds of new ventures" developing new devices to connect with the grid, some of which will have the potential to relay even more personal information.[38]

A. THE FOUR POTENTIAL MODELS OF DATA COLLECTION BY SMART METERS

Simply because smart meters can transmit all personal energy data to the grid does not necessarily mean that they must do so. Depending on what information energy companies find to be critical for system operations, smart meters and the grid itself could have built-in limitations when providing or collecting data.[39] The current grid does not collect or use real-time energy usage data,[40] thus making it a relatively "dumb" information collection model. In moving away from the ineffective "dumb" model, the grid designers could use any one of four potential designs to dictate how data will flow from consumers to the grid.

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[35] David Weinburger, *The Grid, Our Cars and the Net: One Idea to Link Them All*, Autopia, http://www.wired.com/autopia/2009/05/the-grid-our-cars-and-the-internet-one-idea-to-link-them-all (May 8, 2009, 11:57 EST).

[36] Mariah Blake, *Grid Unlocked*, WASH. MONTHLY, May/June 2009, at A9.

[37] *Id.*

[38] *Id.* at A13.

[39] *See generally* LAWRENCE LESSIG, CODE: VERSION 2.0 5 (Basic Books 2006) (the architecture, or "the software and hardware," of a new technology has the capacity to promote values by regulating, or not regulating, certain behaviors by users).

[40] SHERRY LICHTENBERG, NAT'L REGULATORY RESEARCH INST., SMART GRID DATA: MUST THERE BE CONFLICT BETWEEN ENERGY MANAGEMENT AND CONSUMER PRIVACY? 6 (2010), *available at* http://www.nrri.org/pubs/NRRI_smart_grid_privacy_dec10-17.pdf.

1. THE LIMITED ACCESS SCENARIO

In the limited access scenario, the grid would provide systematic privacy protections that limit the use or availability of data to other parties. Instead of having unfettered access to all information, the grid would be designed to receive usage data in some partial form in order to fulfill the primary goals of the system while protecting individual information.

The limitations on data collection could occur in two major ways. First, the collected data could be transmitted in a *form* that protects personal information. For example, data could be collected in an encrypted form that is understood only by the grid, thereby safeguarding the information from security breaches and limiting the use of data for outside parties like government entities or other companies.

Second, the *extent* of data collection can also be limited in several ways to protect privacy. For instance, the grid could limit the extent of data collection by providing metering data only to necessary parts of the grid. The grid, as defined earlier,[41] comprises many distinct elements, not all of which need complete access to personal data in order to function. Creators would need to analyze what information is vital to each infrastructural element, and determine if it is possible for that element to be shielded from receiving personal metering information. If time-of-use pricing and efficient allocation can be achieved without ever storing usage data, then such information could be used only by infrastructural elements of the grid without being transmitted to any database.

Similarly, grid designers may also consider the length of time that any collected data will be stored. Accurate responses to billing inquiries may require energy data to be stored for some period of time, but it is unclear whether this information will have any clear value to the functionality of the grid itself. Finally, instantaneous data could be collected in an aggregated form that incorporates city blocks or communities, though this may be unlikely if it negatively impacts the time-of-use pricing model.

Because it is difficult to predict the practical effects of such hypothetical suggestions, it remains to be seen whether any limited data collection could still ensure efficient energy allocation. Scenarios like those mentioned above could prevent energy companies from corroborating usage data in billing complaints, but such a system also

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[41] *See infra* App. A.

has the potential to protect both privacy and security by making collected usage information useless or unavailable to outside parties. In its grading criteria for federal stimulus funding, the Department of Energy has put some emphasis on keeping metering information private. Specifically, it states that Smart Grid Investment Grant proposals will be given a high merit ranking if research models can make data collection confidential.[42] Potential limited access scenarios, therefore, may merit some research in order to determine whether and in what ways the system can protect individual privacy while still achieving its goals.

2. THE HOUSEHOLD SCENARIO

Under the household scenario, smart grid designers would create an aggregated system that collects real-time energy usage for a household. Sometimes called a "bottom-up" system (see the diagram below),[43] consumers would use meter data management systems (MDMS) that give individuals command over how their appliances are used and advise consumers about ways to lower energy costs.[44] Once settings are in place, the smart meter sends the total usage demand figures to the grid that then allocates the energy accordingly. Theoretically, an MDMS could be accessed from anywhere, allowing for easy correction of potentially costly mistakes when, for example, an individual leaves home with an iron turned on or goes on vacation without turning off the air conditioning.[45]

This system would provide privacy protections by ensuring that that the individual customers, and not the power company, would access his or her usage data and manage their consumption. This could be problematic, however, because the grid itself would have less control over how energy is used. Instead, energy usage would be

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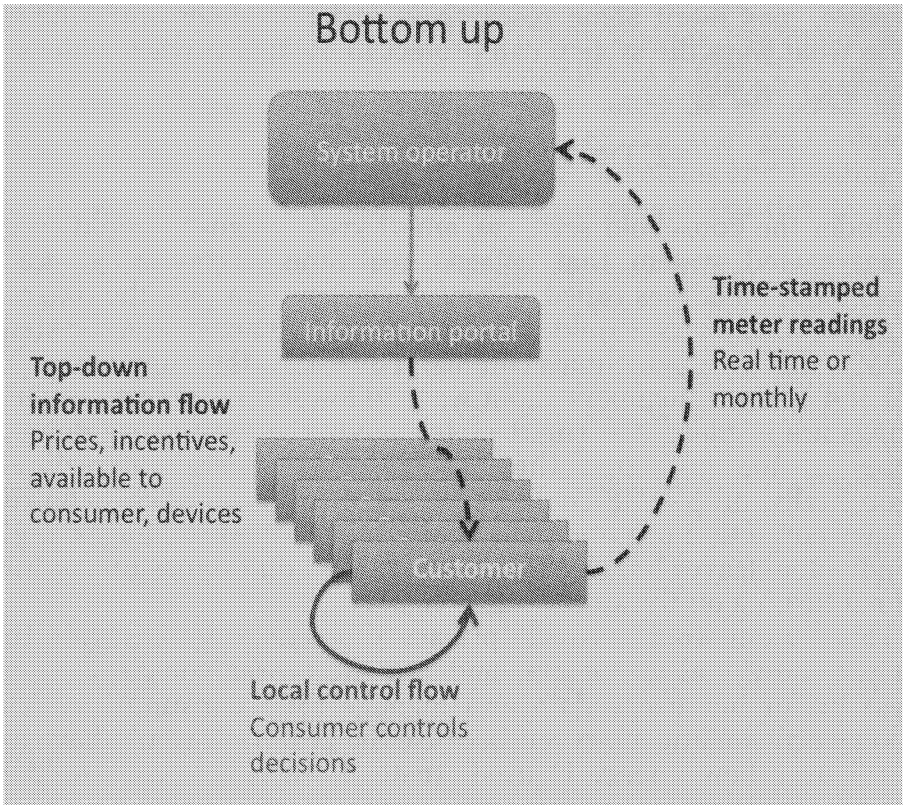
[42] U.S. DEPT. OF ENERGY, OFFICE OF ELEC. DELIVERY AND ENERGY RELIABILITY, FUNDING OPPORTUNITY NO. DE-FOA-0000058, ELEC. DELIVERY AND ENERGY RELIABILITY RESEARCH, DEVELOPMENT AND ANALYSIS 41(2009), *available at* http://e-center.doe.gov/iips/faopor.nsf/UNID/39C0D96768F2083F8525759A0068F216/$file/DE-FOA-0000058%5B1%5D.rtf.

[43] Hines, Bongard, & Berkins, *supra* note 16.

[44] *See* Microsoft's Hohm system or Google's PowerMeter program, for examples.

[45] *Remote Metering Introduced in Ottawa*, Smart Meter News, http://www.smartmeters.com/the-news/584-remote-meter-reading-introduced-in-ottawa.html (last visited Apr. 18, 2011).

determined based on individual preferences. This could potentially promote greater efficiency for the grid as a whole, but such a benefit is not guaranteed. Regardless of whether the grid accesses the data from the household in a real-time form or at time-stamped intervals, the fact that the data would be in aggregated form would offer some protection to consumers.



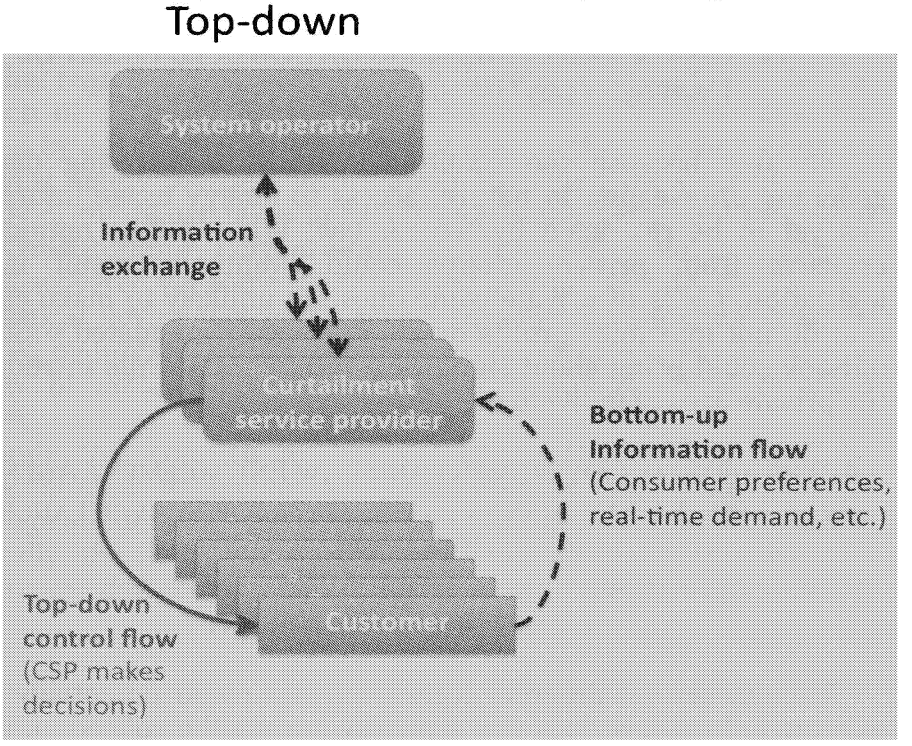
3. THE ALL-KNOWING SCENARIO

The smart grid architects could also potentially undertake an all-knowing model where smart appliances and other items communicate directly with the grid. Here, the grid would use a "top down" control model where information flows directly from the devices to the database, and the database then makes decisions about where to send power (see diagram below).[46] These appliances will connect to the grid

[46] Hines, Bongard, & Berkins, *supra* note 16, at 4.

directly and limit times of operation to when, for example, wind turbines are spinning or overall energy demand is lower. In Washington State, test research has found that smart appliances, which are already being developed by several major companies,[47] can lower consumer energy bills by ten percent and reduced overall energy usage during peak hours by fifteen percent.[48]

On a broader scale, this would ensure that energy is distributed most efficiently from the grid's perspective. From an individual standpoint, however, this model could be problematic because it provides the grid with the most personal information while also significantly reducing individual control of energy consumption.



[47] Lynne Kiesling, *Smart Grid Device Update,* Knowledge Problem, http://knowledgeproblem.com/2009/06/30/smart-grid-device-update/ (June 30, 2009, 04:28 EST).

[48] KIESLING, *supra* note 23, at 2.

4. THE COMBINATION SCENARIO

The potential systems described above are not exclusive, and it seems likely that some aspects of one model could be utilized with ideas from another. One could certainly imagine, for instance, grid models that collect all information from appliances in an encrypted format, or that allow individuals to program their own devices for energy use while still collecting the data. Furthermore, the potential existence of different opt-out models could bring about variations in the level of data transmissions of households.

IV. USES OF SMART METERING DATA WOULD LIKELY BE UNREGULATED UNDER CURRENT FEDERAL LAW.

Possibly because the traditional forms of metering data are generally unrevealing in nature, access to energy usage information has yet to be restricted by federal law. While public opinion and criticism from privacy groups could eventually result in new legislation, CEOs of private companies are unlikely to make changes that do not maximize profits or are not legally mandated.[49] Such an outlook could bring about significant future costs while intruding on the private lives of individuals.

A. THE FEDERAL GOVERNMENT AND LAW ENFORCEMENT AGENCIES WILL LIKELY HAVE ACCESS TO THIS DATA FOR SURVEILLANCE OR TRACKING.

1. THE FOURTH AMENDMENT

Though several different legal doctrines could potentially apply, existing federal law does not explicitly govern the collection, use, or distribution of advanced metering data by government agencies. In *U.S. v. Miller*, the Court determined that Fourth Amendment restrictions on searches do not apply when government agents access information from third parties.[50] Specifically, the Court allowed prosecutors to enter into evidence the defendant's banking records

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[49] Quinn, *supra* note 21, at 29.

[50] U.S. v. Miller, 425 U.S. 435, 435 (1976).

and account activity acquired from the bank.[51] This is because, according to the Court, voluntary conveyance of personal information to a service provider invalidates any reasonable expectation of privacy and the information can therefore be accessed by governmental agencies without probable cause.[52] The Ninth Circuit, following the holding in *Miller*, applied the voluntary conveyance limitation of the Fourth Amendment to electric utility records because, by giving usage information to energy providers, consumers relinquish their subjective assumption of privacy.[53]

In another line of cases, the Court dictates that the Fourth Amendment protects information deemed to be highly personal. However, the holdings of these cases are probably too narrow to incorporate smart metering data. In *Kyllo v. U.S.*, the Supreme Court found that searches performed through thermal imaging fell under the definition of a Fourth Amendment search.[54] The majority opinion, authored by Justice Scalia, emphasized that methods of investigation that reveal highly personal information, including the hour in which "the lady of the house takes her daily sauna and bath," are protected by the Constitution.[55] Furthermore, even if non-personal information can be discovered via some other method of investigation, the use of a technological device that could reveal personal information must be prompted by probable cause because "no police officer would be able to know *in advance*" whether his search would reveal intimate details.[56]

Despite this concern for privacy rights, the holding in *Kyllo* remains limited to instances where searches are performed by technological devices that "are not in general public use."[57] Specifically, the Court was most concerned with highly invasive new technological devices that could, for example, "see through walls."[58]

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[51] Miller, 425 U.S. at 446.

[52] *Id.*

[53] U.S. v. Starkweather, 972 F.2d 1347 (9th Cir. 1992) (unpublished table decision).

[54] Kyllo v. U.S., 533 U.S. 27, 40 (2001).

[55] *Id.* at 38.

[56] *Id.* at 39.

[57] *Id.* at 40.

[58] *Id.* at 36.

The Court states its test in simple terms: "A Fourth Amendment search occurs when the government violates a subjective expectation of privacy that society recognizes as reasonable."[59] The standard itself, then, is not constant, as changes to technology affect society's reasonable expectation of privacy. Because all energy users could eventually have smart meters, it is unlikely that energy data would fall under Fourth Amendment restrictions.[60] In their article, "Taking the 'Long View' on the Fourth Amendment: Stored Records and the Sanctity of the Home," Jack Lerner and Dierdre Mulligan called on the Supreme Court to expand the Fourth Amendment, based on the personal information protection aspect of the *Kyllo* holding, to protect advanced metering data.[61] As stated by Judge Posner, however, even mass surveillance techniques that avoid physical intrusion remain unregulated under current case law.[62]

2. THE PRIVACY ACT OF 1974

Federal statutes also permit government use of energy data under current interpretations. The Privacy Act of 1974 provides the primary statutory restriction for accessing government databases.[63] Under the Privacy Act, the government must provide notice when collecting information, allow individuals to see the collected information, maintain accuracy of these records, and gain consent when they wish to disclose records to third parties or other agencies.[64] The consent requirement has many exceptions, including a vague "routine use" loophole for agencies, and permits law enforcement access when "authorized by law."[65]

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[59] Kyllo, 533 U.S. at 33.

[60] *Id.* at 33–34.

[61] Jack I. Lerner & Deirdre K. Mulligan, *Taking the "Long View" on the Fourth Amendment: Stored Records and the Sanctity of the Home*, 2008 STAN. TECH. L. REV. 3, at ¶¶ 17–18 (2008).

[62] U.S. v. Garcia, 474 F.3d 994, 998 (7th Cir. 2007).

[63] INTERNET SECURITY AND PRIVACY ADVISORY BOARD, TOWARD A 21ST CENTURY FRAMEWORK FOR FEDERAL GOVERNMENT PRIVACY POLICY 9 (2009), *available at* http://www.securityprivacyandthelaw.com/uploads/file/ispab-report-may2009.pdf.

[64] *Id.*

[65] Privacy Act, 5 U.S.C. § 552a (1974).

Because the Privacy Act affects only government records, its restrictions will not apply to energy data because, in all likelihood, the database of advanced metering information would be collected and maintained by private companies. Even if the Department of Energy chooses to maintain these records, however, the Privacy Act may not govern this form of data because the Act's outdated "system of records" definition—information must be regularly "retrieved by the name of the individual or by some identifying number, symbol, or other identifying particular assigned to the individual"—is not well suited for new methods of data collection.[66] Circuit courts have found that databases using other methods of searches do not fall under the system of records definition unless records are regularly *retrieved* by a single numeric identifier.[67] Thus, the fact that a database uses identification numbers would still not subject it to the Privacy Act restrictions unless those numbers are considered a common method of search.

3. THE ELECTRONIC COMMUNICATIONS PRIVACY ACT

The Electronic Communications Privacy Act (ECPA)[68] limits access to communications made through governmental or private databases. However, while the ECPA could potentially place some restrictions on energy data access, the provisions guarding stored communications would almost certainly not apply to metering data. The Act distinguishes between real-time interception of information (the wiretapping restrictions in Title I) and accessing stored information, which has more lenient requirements in Title II of the ECPA (known as the Stored Communications Act (SCA).

Title I of ECPA requires that the interception of real-time communication data be pursuant to a court order.[69] Electronic communications, as defined by the statute, include data transmitted

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[66] *Id.*; *see also* INTERNET SECURITY AND PRIVACY ADVISORY BOARD, *supra* note 59, at 31–32 (recommending that the quoted language be removed from the statute because, as shown through DHS's ADVISE data mining system's failure to fall under the statute, the definition inadequately covers new forms of data collection that utilize several sources for collection and retrieval).

[67] Henke v. U.S. Dep't of Commerce, 83 F.3d 1453 (D.C. Cir. 1996).

[68] Elec. Commc'n Privacy Act, Pub. L. No. 99-508, 100 Stat. 1848 (codified in scatter sections of 18 U.S.C.).

[69] 18 U.S.C. § 2511(2)(a)(ii) (2000).

by "wire, radio, electromagnetic, photo-electronic, or photo-optical system that affects interstate commerce."[70] Courts have found that interception of satellite television usage data via a device falls under the constraints of Title I of ECPA.[71] Like satellite television usage data, advanced metering data may directly impact interstate commerce because it dictates billing.[72] Furthermore, because of PHEVs, storage units will likely cross state lines and then be connected to the grid, thereby affecting commerce in another state. Since metering data could be deemed as information affecting interstate commerce, such information could fit under the statute. Only speculative guesses can be made regarding the applicability of Title I, however, because the smart grid's means of communication have yet to be determined.

While this appears to set a high probable cause standard for access, an exception to this rule permits access to the communications if one party to a transmission consents to surveillance.[73] In the context of smart grid communications, the utility would be the recipient of the communication, so a question remains as to whether the provider could consent to government access of the communication. Though this exact question has yet to be addressed, one court found that when an individual willingly communicates with a health services provider that has consented to giving information to a web-tracking company, the surveillance falls under the consent exception and is permissible.[74] This exception, therefore, applies to both government surveillance and access by private entities.

Unlike under Title I of the ECPA, government entities can access stored databases of such communications under Title II in five ways: a subpoena, a subpoena with prior notice to consumer, a court order, a court order with prior notice to customer, or a search warrant.[75] Of these options, only the search warrant requires the establishment of probable cause. Furthermore, when a service is provided to the

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[70] 18 U.S.C. § 2510(12) (2002).

[71] DIRECTV, Inc. v. Pepe, 431 F.3d 162 (3d Cir. 2005).

[72] In many states, utilities providers are required by law to produce records of a customer's usage data over a period of time. *See, e.g.*, OHIO ADMIN. CODE 4901:1-13-12(E) (2006) (upon customer request, a utility must provide the last twelve months of usage data and the last twenty-four months of payment history).

[73] 18 U.S.C. § 2511(2)(c) (2000).

[74] In re Pharmatrak, Inc. Privacy Litigation, 220 F.Supp.2d 4 (D. Mass. 2002).

[75] Stored Commc'n Act, 18 U.S.C. § 2703 (2000).

public, providers may voluntarily give information to government agencies in a variety of circumstances.[76]

In addition to relaxed access limitations, the limited scope of the SCA will also likely permit government usage of stored energy data. Unlike with interception of real-time data, Title II of the ECPA limits access to stored communications only when they are held by a "person or entity providing an electronic communication service" or "remote computing service."[77] Airline companies, which use electronic communications but are not deemed to be service providers, have been found to be outside of the scope of ECPA in some jurisdictions, making online orders or consumer traveling information available to government agencies.[78] Like airline companies, energy companies would likely avoid the regulations of the SCA because data collection is secondary to their main function of providing electricity to consumers.

B. PRIVATE COMPANIES MAY HAVE ACCESS TO METERING INFORMATION FOR MARKETING OR OTHER PURPOSES.

1. SECTION FIVE OF THE FEDERAL TRADE COMMISSION ACT

Section Five of the Federal Trade Commission (FTC) Act prohibits all companies from performing "deceptive acts or practices in or affecting commerce."[79] This restriction extends to instances when a company action contradicts its own privacy policy.[80] While the FTC Act may offer some guarantees of privacy protection, there are no federal statutory mandates requiring privacy policies or dictating what they should contain.

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[76] 18 U.S.C. § 2702(b) (2008).

[77] 18 U.S.C. § 2702(a) (2008).

[78] Dyer v. Nw. Airlines Corps., 334 F.Supp.2d 1196, 1199 (D.N.D. 2004).

[79] Fed. Trade Comm'n Act, 15 U.S.C. § 45(a)(1) (1914).

[80] *Id.; see also* Complaint at ¶¶ 11-16, In re Gateway Learning Corp, 138 F.T.C. 443, No. 042-3047 (2004), *available at* http://www.ftc.gov/os/caselist/0423047/040917comp0423047.pdf.

Even though self-regulation has been encouraged by the FTC in some fields,[81] companies are free from regulation regarding the creation and contents of their privacy policies. For energy companies, privacy policies that protect metering data have yet to become standard practice, and the FTC cannot prosecute any privacy violations as deceptive if the company has not created a privacy policy at all. One potential solution for this problem could be for Congress to require companies to create privacy policies, but the creation of these policies at a time when the system's architecture has yet to be fully determined could prove to be problematic. Companies would need to expend significant resources to ensure the accuracy of their policies and keep their customers informed of any necessary changes. At such an early stage, this solution may not be the most efficient.

2. THE ROLE OF FEDERAL AGENCIES

The smart grid incorporates the interests of many different agencies that may all play a role in regulating and researching the implications of smart meters. From a privacy standpoint, two documents stand out above the rest. The first is the Federal Communications Commission's (FCC) National Broadband Plan, which sets forth the terms of an ambitious national investment in broadband communications.[82] Within this plan, the FCC notes the importance of providing consumers with information regarding energy usage, and expresses its intent to incorporate smart metering technology into the broadband initiative.[83] This is problematic, however, because the plan itself fails to adequately discuss privacy and security issues relating to this information.[84] Furthermore, the plan calls for states to implement policies to provide consumers access to consumer usage data by September 2011 or be subjected to federal legislation.[85] Pushing forward with such a plan so quickly, before the

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[81] FED. TRADE COMM'N, STAFF REPORT: SELF-REGULATORY PRINCIPLES FOR ONLINE BEHAVIORAL ADVERTISING (2009), *available at* http://www.ftc.gov/os/2009/02/P085400behavadreport.pdf.

[82] FED. COMMC'NS COMM'N, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN (2010), *available at* http://download.broadband.gov/plan/national-broadband-plan.pdf.

[83] *Id.* at 254–55.

[84] Letter from the Electronic Privacy Info. Center to the Federal Trade Comm'n (June 8, 2009), *available at* http://epic.org/privacy/pdf/fcc_broadband_6-8-09.pdf.

[85] THE NAT'L BROADBAND PLAN, *supra* note 81, at 256.

infrastructure of the grid has been finalized and before the privacy issues have been adequately considered within it, could have significant implications on the privacy rights of consumers.

The other significant document, released in the fall of 2010 by the National Institute of Standards and Technology (NIST), outlines specific privacy approaches that all actors within the grid should take during its implementation.[86] The NIST has the "primary responsibility to coordinate development of a framework that includes protocols and model standards for information management to achieve interoperability of smart grid devices and systems."[87]

In creating this document related to privacy, the NIST addresses many of the issues from this Note, reaching similar conclusions regarding privacy impact assessments[88] and other issues. While this document shows that consideration is being given to privacy issues, the NIST's role is simply to recommend model practices, and it lacks any formal enforcement powers.

3. STATE REGULATIONS

State regulations typically provide the most significant regulations of energy data access by non-governmental third parties.[89] In most states, these regulations dictate what information belongs to customers and what information must be protected by energy companies. Under many state regulations, customer usage information belongs to the customer, and energy companies must get permission before they release it to other private parties.[90]

These regulations vary from state to state, however, and situations can arise where data will be released in order to serve a legitimate purpose. When people consider buying a home, for example, it is

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[86] NAT'L INST. OF STANDARDS AND TECH., GUIDELINES FOR SMART GRID CYBER SECURITY: VOL. 2, PRIVACY AND THE SMART GRID (2010), *available at* http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf.

[87] Energy Independence and Security Act, Pub L. No. 110-140, § 1305a (2007).

[88] *See* NAT'L INST. OF STANDARDS AND TECH., *supra* note 84, at 4.

[89] For a list of state regulatory authorities, *see* The Utility Connection, State Utility Regulation, http://www.utilityconnection.com/page5.asp#StateRegulation (last visited Mar. 22, 2011).

[90] *E.g.*, OHIO ADMIN. CODE 4901:1-13-12(D) (2006) (requiring written consent of the customer to release information, aside from an account number, in nearly all situations).

plausible that they would want to know average utility data in order to guide their decision. Whether or not energy companies can release such information, however, depends on the state statutes and regulations.

While states have been given authority to regulate electricity, the rising federal interest in the smart grid and the interconnectivity of the grid network could eventually result in a move toward national regulations. Some have called for a nationalization of energy policies in order to bring about greater consistency and ensure that energy investments are most effective.[91] In terms of federal privacy protections for energy data, such a policy would make sense because a national grid would likely be capable of sending data across state lines. Without federal regulation, firms in states with stringent data regulations could nonetheless find themselves with easy access to private information from states with more lenient standards. From a financial standpoint, states could have an incentive to have fewer privacy protections because companies could generate significant taxable revenue by selling personal information.

In its smart grid policy statement, the Federal Energy Regulatory Commission (FERC) seems to give tentative authority to states regarding privacy regulations, but it opens the door for expanding the scope of federal authority in the future. In addressing jurisdictional concerns raised by state commissions, FERC establishes that it does not believe that the "adoption of national standards for smart grid technologies should interfere with a state's ability to adopt whatever advanced metering or demand response program it chooses."[92] FERC also states, however, that its jurisdiction over states will be determined on a case-by-case basis, and that it already has authority to "adopt smart grid standards—such as meter communication protocols or standards—that affect all facilities . . . if the Commission finds that such standards are necessary for smart grid functionality and interoperability in interstate transmission of electric power, and in regional and wholesale electricity markets."[93] So while state commissions retain their jurisdiction over metering regulations, their

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[91] Alex Yu Zheng, *Former Shell President Calls for Federal Energy Regulatory Board*, Smart Grid News, http://www.smartgridnews.com/artman/publish/News_Blogs_News/Former_Shell_President_Calls_for_Federal_Energy_Regulatory_Board-571.html (Apr. 21, 2009).

[92] Smart Grid Policy, 74 Fed. Reg. 37,098, 37,102 (July 27, 2009) (to be codified at 18 C.F.R. pt. 1).

[93] *Id.* at 37,100.

power to do so could be short lived if FERC chooses to expand its standards.

V. PREEMPTIVE CONSIDERATION OF PRIVACY RIGHTS BY LEGISLATORS AND PRIVATE COMPANIES MAY HELP ENSURE THE SUCCESS OF THE SMART GRID AND REDUCE SOCIAL COSTS.

At the heart of privacy rights lies a deep-rooted sense that some information is personal and not open to other parties. Often, privacy arguments can take a moralistic approach, condemning companies or government agencies for violating personal dignity.[94] From a government standpoint, a situation where a state has free reign over personal data may help prevent crimes and help serve the public good, but the ability to use this information for any legal end would limit freedom while also creating uneasiness regarding access to this data, even if such searches were noninvasive.[95] Furthermore, use of this data by commercial businesses, for a variety of purposes, can bring about many negative practices that utilize profiling, manipulation, price discrimination, and a general sense of inequality.[96]

The financial implications of privacy violations, however, would probably have the most significant impact on company policies. Failing to account for privacy rights can result in significant monetary losses. As Anne Cavoukian writes, "Privacy is good for business."[97]

Looking at the past history of how the Fourth Amendment and current statutes protect personal information, it seems probable that Congress will pass legislation at some point in order to protect energy usage data. After the Supreme Court decided that bank records were not governed by the Fourth Amendment in *Miller*, Congress responded by passing the Right to Financial Privacy Act.[98] The ECPA also was a response to the Supreme Court decision in *Smith v. Maryland* that permitted government access to telephone toll

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[94] *See* LESSIG, *supra* note 37, at 210–12 (juxtaposing the dignity argument against data collection with Judge Posner's view that data collection through technological systems cannot invade privacy).

[95] *Id.* at 213–14.

[96] *Id.* at 215–22.

[97] ANN M. CAVOUKIAN, INFO. AND PRIVACY COMM'R REPORT, PRIVACY BY DESIGN 4 (2009), *available* at http://www.ipc.on.ca/images/Resources/PrivacybyDesign%20Book-ch1.pdf.

[98] 12 U.S.C. § 3401 (2003).

records.[99] Thus, it would make sense to help companies and consumers avoid the costs of altering an existing system by crafting pre-implementation legislation instead of waiting and reacting to a post-implementation Supreme Court decision.

A. COMPANIES NOT GIVING PRIVACY PROTECTION CONSIDERATION DURING THE DESIGN PROCESS COULD FACE SIGNIFICANT COSTS AND MISS OUT ON SUBSTANTIAL BENEFITS.

Energy companies can avoid the costs of future litigation and public relations backlashes by incorporating privacy policies into their new technologies. Other industries, like the behavioral advertising market, have faced significant litigation fees as a result of privacy conflicts.[100] The rise of such litigation has resulted in some federal policy changes that have been significant enough for companies to hire Chief Privacy Officers as legal and technological advisors.[101] In a self-regulatory manner, creators of major websites have begun to change their policies throughout the industry to become more privacy friendly.[102] However, these companies, and privacy rights as a whole, have been impaired because this issue was not considered early on in the development of this new technological medium.

The creation of new legal requirements can be particularly costly for businesses in several ways. First, businesses will have to design new technologies or alter those that have already been created in order to satisfy the new regulations. New research, design, and the repair or replacement of old models could cost a significant amount if a company has not implemented any protections in the original model. Meanwhile, the time spent redesigning existing elements of the grid could have been used to further develop smart grid technologies.

Self-regulation, if sufficiently vigilant, can also be economically useful if it preempts legislative responses that can prove inflexible or even obsolete when enacted. New statutory regulations can be problematic when they deal with or define technological terms.

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[99] Smith v. Maryland, 442 U.S. 735 (1979).

[100] *See* Bureau of Consumer Prot., Legal Resources, http://business.ftc.gov/legal-resources/8/35 (last visited May 5, 2011) (detailing list of enforcement cases brought by FTC against violators of the FTC Act).

[101] ANN CAVOUKIAN & TYLER J. HAMILTON, THE PRIVACY PAYOFF: HOW SUCCESSFUL BUSINESSES BUILD CONSUMER TRUST 128 (McGraw-Hill 2002).

[102] *See, e.g.*, Stored Commc'n Act, *supra* note 73.

Because of its ever-changing nature, technology is rarely well-defined or classified.[103] Static laws may therefore become unnecessary burdens on technological innovation in some cases. Self-regulation, on the other hand, would offer more flexibility and could still protect privacy rights while allowing for progress.

Regulation may be too restrictive if it is created chiefly as the result of public backlash. Legislation can be fairly unpredictable, and a public furor over a particular issue, particularly during election years, can impact new regulations. When behavioral advertising issues were discussed at a recent hearing conducted by the House Energy and Commerce Committee, one Republican House member warned that, despite the obvious privacy concerns that data collection can raise, "overreaching" legislation could bring about more harm than good, particularly if no financial damages are incurred by the public.[104] Companies, therefore, may be prudent in trying to prevent a public relations issue, as well as overly strict legislation, by addressing privacy rights early in the design process.

Along with protecting against new legislation, companies will have an interest in promoting public confidence in the smart grid because of the role that consumers will play in its implementation. Because the new grid's creation will be funded primarily by consumers and taxpayers, the support of the general public will be a crucial factor in ensuring the project's development.[105] While smart technologies may lower monthly bills in the long run, expensive meters and significant federal funding have already begun to create dissatisfaction among consumers in smart grid testing sites.[106] If significant privacy risks are added to the list of consumer grievances, many may call for an end to federal funding of this project.

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[103] *See, e.g.*, 5 U.S.C. § 552a(5).

[104] *Joint Hearing on Behavioral Advertising: Industry Practices and Consumers' Expectations Before the H. Comm. On Energy and Commerce, Subcomm. On Communications, Technology and the Internet*, 111th Cong. 18 (2009) (statement of Rep. Cliff Stearns, Member, Subcomm. on Communications, Technology, and the Internet).

[105] *See* Katherine Ling, *Standards, Consumer Education Needed for 'Smart Grid' to Work, Sen. Murkowski Says*, N.Y. TIMES, Mar. 4, 2009, *available at* http://www.nytimes.com/gwire/2009/03/04/04greenwire-standards-consumer-education-needed-for-smart-g-9975.html (Senator Murkowski stated, "Pilot programs must be carefully structured in such a way that creates a 'buzz' and excitement, not a ratepayer revolt.").

[106] Rebecca Smith, *Smart Meter, Dumb Idea?*, THE WALL ST. J., Apr. 27, 2009, *available at* http://online.wsj.com/article/SB124050416142448555.html.

Aside from paying for the new grid, consumers will play a vital role in ensuring its progress. By learning how to use smart meters and changing their behavior, consumers will receive personal and public benefits in the forms of lower electric bills, more consistent energy distribution, reduced pollution, and a potential increase in energy-related jobs. Also, by providing energy to the grid through solar panels or storing it through electric automobiles, individual consumers will play a significant role in the practical functioning of the grid through investment in new products. By considering privacy rights from the start, grid creators can avoid ostracizing many individuals and better ensure that the public will "buy in" to the grid.

While avoiding smart grid privacy issues in developmental stages may be costly, companies that protect personal information could also stand to benefit significantly in the energy market. The smart grid has been described as the "largest economic opportunity in the twenty-first century," and companies like Google, Cisco, AT&T, and GE have already entered into the market.[107] In a field with such high potential, competitive advantages can play a significant role in a company's success.[108] By building consumer trust through privacy protection, companies can foster greater customer satisfaction and loyalty that will ultimately benefit their bottom-line.[109] Meanwhile, companies who do not account for the rights of consumers will be playing catch-up in a field where new products will be created daily that may bring about astronomical revenues for companies.[110]

B. ENERGY COMPANIES AND APPLIANCE MANUFACTURERS CAN PREVENT PRIVACY INFRINGEMENTS BY PROVIDING SAFEGUARDS IN THE DESIGN OF THE GRID.

While the right to use personal information may be legitimate in many circumstances, using personal data without adequate notice may violate an individual's rights and could prove to be costly when discovered by privacy-conscious members of the public.[111] Companies

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[107] Mariah Blake, *Grid Unlocked*, WASH. MONTHLY, May/June 2009, at A9, A12.

[108] Cavoukian, *supra* note 95.

[109] *Id.*

[110] *See* Blake, *supra* note 105, at A13.

[111] *See* Bureau of Consumer Prot., *supra* note 100.

have started to recognize the importance of privacy rights. Even Google, much maligned within sectors of the internet privacy community, has stated before Congress that "personal energy information belongs to consumers, and they should control who has access to it."[112]

In order to ensure public support of the smart grid, industry leaders and companies should implement a "privacy by design" approach by assessing "the impact of a system or process on individuals' privacy . . . throughout the system's lifecycle."[113] This evaluative process should begin during the initial design phase, and the impact on privacy should continually be assessed in order to ensure "that appropriate controls are implemented and maintained."[114] By taking this lifecycle approach, system controls of privacy should be "stronger, simpler, and therefore cheaper to implement, harder to by-pass, and fully embedded in the system as part of its core functionality."[115]

While there are benefits to protecting privacy rights while implementing the smart grid, the goal of this Note is not to advocate one particular model over another. The smart grid remains in the experimental and design phases of its lifecycle, and pushing for one particular method of protection before it is fully tested could cancel out some of the benefits that the smart grid will hopefully provide for society.

Instead, this Note has outlined some facets of this privacy issue in the hopes that the grid designers will give consideration to privacy rights during the design process. In testing sites for the smart grid, different protections and models could be analyzed to determine the best system for ensuring progress and guarding personal privacy. Some of these models could include the different takes on the limited access scenario or include aspects of the household scenario.[116]

Furthermore, companies could use Privacy Impact Assessment (PIA) forms to guide their design process. A practical means for

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[112] Blake, *supra* note 105, at A13.

[113] INFO. COMM'RS OFFICE, PRIVACY BY DESIGN 7 (2008), *available at* http://www.ico.gov.uk/upload/documents/pdb_report_html/privacy_by_design_report_v2.pdf.

[114] *Id.*

[115] *Id.*

[116] *Supra* Section II.

privacy by design, PIAs are mandatory evaluations that government entities must complete throughout the developmental process of a new system.[117] While private corporations are not required to complete PIAs, the forms can provide a useful template that considers many different aspects of privacy protection.[118] Below are some privacy-related questions that researchers and designers may wish to ask that are based on the main points of PIA forms.

1. *Collection of Data* – What are the intended uses of energy usage figures? What information is needed to achieve the goals of the grid? Can energy be collected in two forms: monthly billing information and energy distribution information?

2. *Storage and Encryption of Data* – Can personal information be encrypted or aggregated without affecting the overall goals of the system? Who will have access to this data and to what extent? How long will the data be stored in the system? How will stored data be accessed or searched? What protections will be in place protecting against employee breach?

3. *Notice* – In a context where even websites struggle to provide adequate notice to users, how can designers give notice to something people have been doing for years through a product in someone's basement? More specifically, what are the most effective means of providing consumers with notice of the types and amounts of data that smart meters will collect and convey, and of the ways that utilities and third parties will use this information?

4. *Consent* – To what extent should consumers have to consent to the release of their energy consumption data? Can users opt-out of the system entirely, or, if that is not possible, limit their participation and the information they convey to the grid? Can the grid be effective if it utilizes only aggregated data?

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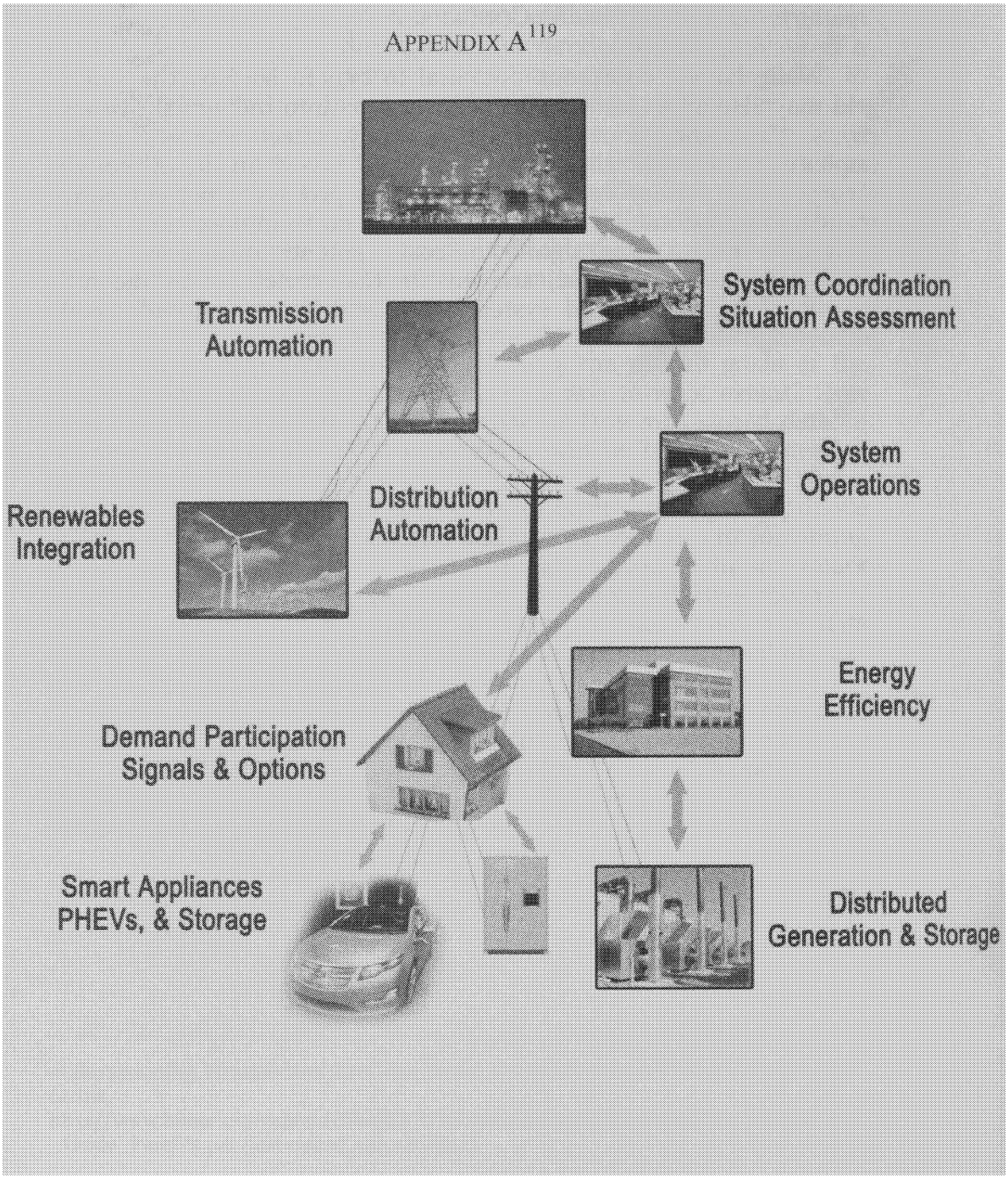
[117] *See generally,* HEALTHCARE INFO. AND MGMT. SYS. SOC'Y, PRIVACY IMPACT ASSESSMENT GUIDE, http://www.himss.org/content/files/CPRIToolkit/version6/v6%20pdf/D87_HIMSS_PIA_Guide_FinalV2.pdf (last visited Apr. 18, 2011).

[118] *See* DEPT. OF THE INTERIOR, PRIVACY IMPACT ASSESSMENT TEMPLATE, *available at* http://www.doi.gov/ocio/privacy/Interior%20Privacy_Assessment_Template_No%20Explanations.doc.

V. CONCLUSION

While having enormous potential to benefit society, the smart grid may also allow for significant intrusions into individual privacy rights. These intrusions could detrimentally affect both the grid's implementation and the companies that invest in it. Although incorporating privacy issues into the design process is not currently mandated by federal law, companies should do so in order to protect their investment, avoid significant costs, potentially increase their smart grid-related revenue, and ensure that society reaps the full benefit of the smart grid system while still protecting individual privacy rights.

APPENDIX A[119]



[119] SMART GRID SYSTEM REPORT, *supra* note 2, at 2.